

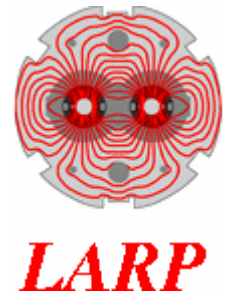
LHC@FNAL

Remote Operations

Erik Gottschalk
Fermilab



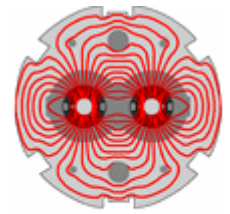
Overview



- **Motivation for LHC@FNAL**
- **Committee charge and members**
- **Possible Location & Layout at Fermilab**
- **LHC@FNAL Scenarios & Requirements**
- **Site Visits**
- **Current Status**



Motivation for LHC@FNAL

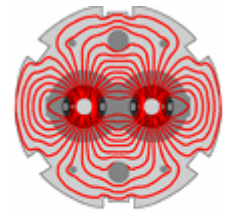


LARP

- 1) Give people who are at Fermilab the ability to participate in CMS and LHC commissioning and operations by providing a suitable environment for remote participation.
 - Hardware and software necessary to participate effectively in CMS and LHC.
- 2) Facilitate communication and help members of the LHC community in North America contribute their expertise to CMS and LHC.
 - An extension of the CERN Control Centre (CCC). For example, to assist in monitoring US-provided LHC magnets and instrumentation, and for remote participation in beam studies and commissioning by US/LARP.
 - An extension of the CMS Control Room. For example, to participate in data-quality monitoring shifts, and to provide a call center for US-CMS collaborators for access to information about CMS and the LHC accelerator.
- 3) A unique opportunity to have detector and accelerator experts in close proximity to each other solving problems together.



Charge



LARP

Charge from Fermilab Director Mike Witherell (April 2005):

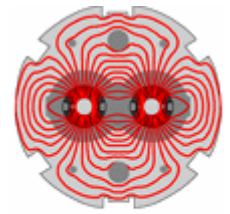
- Define the **high level requirements** for a remote operations center for commissioning and operations of CMS and the LHC accelerator.
- Develop **cost and schedule estimates** for the implementation of a remote operations center.

I would like the committee to prepare a **preliminary report by the end of July 2005**, describing the requirements and scope of a remote operations center located at Fermilab.

The committee should prepare its **final report, including a resource loaded schedule, by the end of 2005.**



LHC@FNAL Committee



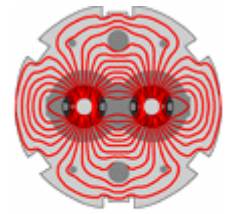
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- Erik Gottschalk – Chair (FNAL-PPD)
- Kurt Biery (FNAL-CD)
- Suzanne Gysin* (FNAL-CD)
- Elvin Harms* (FNAL-AD)
- Shuichi Kunori (U. of Maryland)
- Mike Lamm* (FNAL-TD)
- Mike Lamont* (CERN-AB)
- Kaori Maeshima (FNAL-PPD)
- Patty McBride (FNAL-CD)
- Elliott McCrory* (FNAL-AD)
- Andris Skuja (U. of Maryland)
- Jean Slaughter* (FNAL-AD)
- Al Thomas (FNAL-CD)

* Members of the accelerator subgroup



LHC@FNAL Advisory Committee

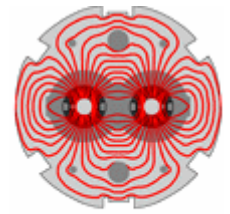


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- Alvin Tollestrup (FNAL-PPD)
- Austin Ball (CERN)
- Avi Yagil (FNAL-PPD)
- Bob Mau (FNAL-AD)
- Dan Green (FNAL-PPD)
- David Rice (Cornell)
- Dragoslav Lazic (Boston U.)
- Frank Glege (CERN)
- Hans Falk Hoffmann (CERN)
- Hermann Schmickler (CERN)
- Jim Kowalkowski (FNAL-CD)
- Jim Patrick (FNAL-AD)
- Joel Butler (FNAL-PPD)
- Katherine Copic (U. of Mich.)
- Lothar Bauerdick (FNAL-CD)
- Margaret Votava (FNAL-CD)
- Mike Church (FNAL-AD)
- Mike Syphers (FNAL-AD)
- Mike Tartaglia (FNAL-TD)
- Roberto Saban (CERN)
- Roger Bailey (CERN)
- Sandor Feher (FNAL-TD)
- Steve Peggs (BNL)
- Vladimir Shiltsev (FNAL-AD)
- Wesley Smith (U. of Wisc.)
- William Trischuk (U. of Toronto)



What is LHC@FNAL?



LARP

1) A Place

- That provides access to information in a manner that is similar to what is available in control rooms at CERN
- Where members of the LHC community can participate remotely in CMS and LHC activities

2) A Communications Conduit

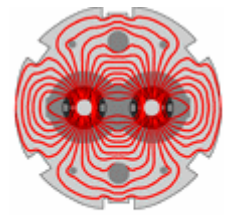
- Between CERN and members of the LHC community located in North America

3) An Outreach tool

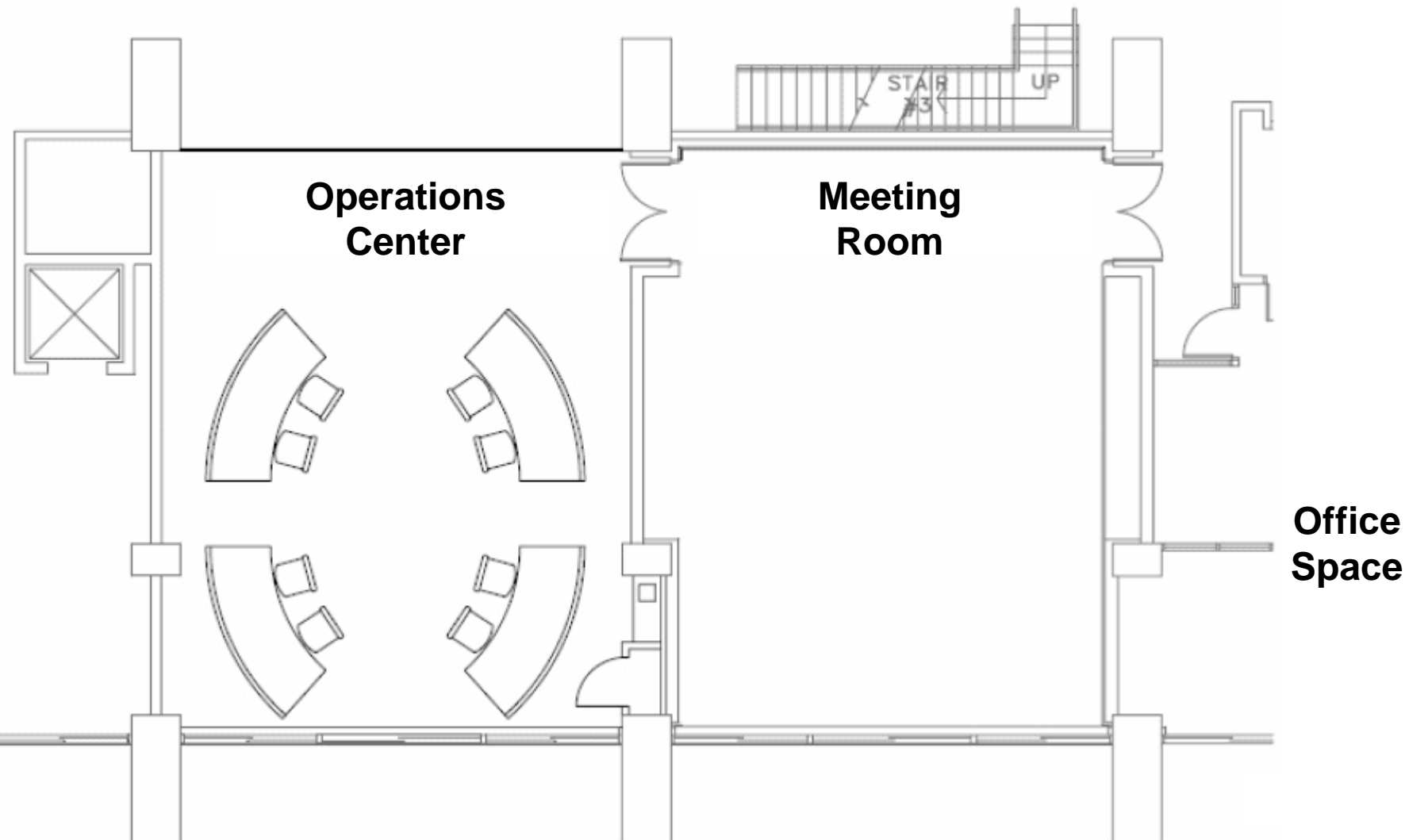
- Visitors will be able to see current LHC activities
- Visitors will be able to see how future international projects in particle physics can benefit from active participation in projects at remote locations.



Possible Location & Layout

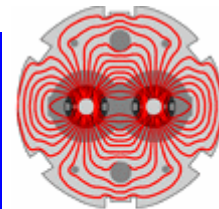


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Possible Location & Layout

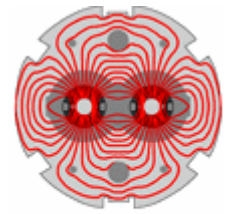


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LHC@FNAL Activities



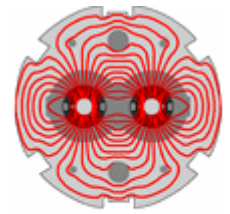
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We developed scenarios to write the requirements document for LHC@FNAL, and we envision the following types of activities for remote participation in LHC activities at CERN:

- Participate in LHC hardware & beam commissioning and operations
- Monitor LHC accelerator components (e.g. systems built in the U.S.)
- Provide service for systems built in the U.S.
- Analyze monitoring data for LHC
- Develop software for LHC
- Provide access to monitoring data and analysis results
- Provide training and data-analysis facility for members of US/LARP
- Provide a rapid response call center to get experts located in North America connected to CERN (data access, operational status, etc.)



LHC Scenarios



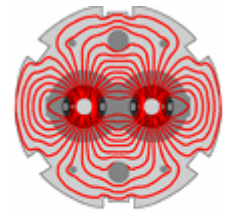
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LHC requirements were developed from six scenarios for LHC accelerator commissioning and operations:

- Hardware commissioning of a US/LARP deliverable
- Software contributions to LHC
- Beam studies from both CERN and U.S. perspectives (2 scenarios)
- Contributions of diagnostics for LHC
- First beam in the LHC



Assumptions



LARP

For LHC

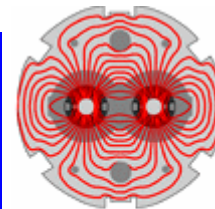
- Individuals working in a Field Control Room (FCR) in the LHC tunnel will have access to telephone communications with international calling capabilities.
- Individuals working at the CERN Control Centre (CCC) will have access to telephone communications with international calling capabilities.
- US/LARP personnel will be at CERN to coordinate activities between the CCC and LHC@FNAL.
- The degree to which LHC@FNAL users have access to the LHC control system will be determined by LHC management.
- The LHC will have a shift schedule and a protocol that defines the roles and responsibilities of CCC shift personnel.
- The LHC will have a protocol that defines how machine commissioning and development activities are scheduled and carried out.

For both CMS & LHC

- LHC@FNAL will comply with all CERN and Fermilab safety and security standards.



LHC Requirements



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Overarching

Hardware Commissioning

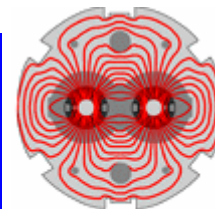
Beam Commissioning

After Commissioning

| | | |
|---|------------------|------------|
| 2 – 1. LHC Confidentiality | | |
| 2 – 2. Enforcement of LHC Confidentiality | | |
| 2 – 3. LHC Space | | |
| 2 – 4. LHC Hardware Commissioning Data Access | 126 | |
| 2 – 5. LHC Hardware Commissioning Logbook | 126 | |
| 2 – 6. FCR Shift Personnel | 126 | |
| 2 – 7. LHC Hardware Commissioning Timescale | 126 | |
| 2 – 8. LHC Daily Schedule Meetings | 138, 213 | |
| 2 – 9. LHC Data Access | 128, 138, 178 | |
| 2 – 10. LHC Configuration Access | 178 | |
| 2 – 11. CCC Communications Channels | 120 | Incomplete |
| 2 – 12. LHC Shift Personnel | 128, 213 | |
| 2 – 13. CCC Software | 120, 178 | |
| 2 – 14. CCC Software Maintenance | 120 | |
| 2 – 15. CCC Console Layout | 120 | |
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CMS/LHC Requirements



LARP

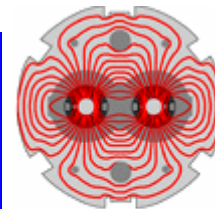
General Capabilities

| | | |
|--|---|--|
| 3 – 1. LHC@FNAL Safeguards | | |
| 3 – 2. LHC@FNAL Hardware and Software Consistency | | |
| 3 – 3. LHC@FNAL Consoles | 120, 138, 213 | |
| 3 – 4. LHC@FNAL Communications | 120, 126, 128, 138, 178, 213, 280 | |
| 3 – 5. LHC@FNAL Shifts | 126, 213 | |
| 3 – 6. LHC@FNAL Record of Shift Schedule | | |
| 3 – 7. LHC@FNAL Directory | | |
| 3 – 8. LHC@FNAL Web Page | | |
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| 3 – 10. LHC@FNAL Shift Area | 213 | |
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| 3 – 16. LHC@FNAL Clocks | 138 | |

Environment



Earlier this year...



LARP

- **Requirements Document**
 - Reviewed on July 21, 2005
 - Revisions made in response to recommendations from reviewers (see next slide)
- **Document submitted to FNAL Director**
 - July 29, 2005
- **Meeting with Pier Oddone August 1st**
 - Enthusiastic response
 - ...“comprehensive document”
 - Discussed location for LHC@FNAL
- **Presentation to CERN AB Management**
 - August 8, 2005 (presented by Mike Lamont)
 - “...project should receive some support from CERN but in view of limited benefits to us, the level of activity should be kept to a bare minimum.”

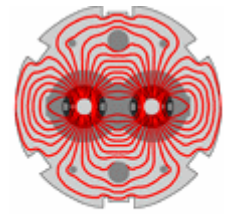
Preliminary
LHC@FNAL Requirements

Document 165

Edited by
Erik Gottschalk, Elvin Hanna, Shuichi Kuroi, Michael Lamm,
Mike Lamont, Kaori Maeshima, Patricia McBride, Elliott
McCreary, Suzanne Parosch, Jean Slaughter



Review Recommendations



LARP

Material for the review and recommendations from the review committee are available on our website:

<http://cd-amr.fnal.gov/remop/remop.html>

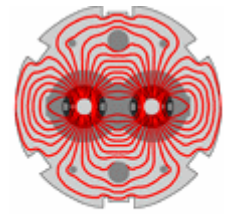
Two of the seven recommendations:

#5: There should be a strong requirement that the Remote Operations Centre should maintain to the greatest extent possible **consistency in hardware and software** with CERN and CMS.

#6: More work needs to be done on the details of how this facility would be used... The project team should **develop an operations model for both CMS and LHC** that explains how the personnel at the Remote Operations Centre will interact with CERN and CMS staff (and members of the LHC community in North America).



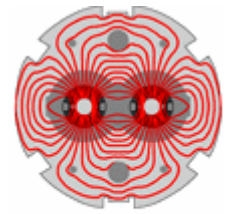
Recent Events



- **Site Visits**
 - Almost completed (see next slide)
- **Department of Energy (DOE) review of LARP**
 - Nov. 2 – 4, 2005
 - Santa Rosa, CA
 - Recommendation: “Pursue involvement in LHC@FNAL activity.”
- **Working with FNAL Facilities Engineering Services Section**
 - Design operations centre, meeting room and office space
 - Develop cost and schedule estimates
- **Working on final report and resource loaded schedule**
 - Assume LHC@FNAL will use the same consoles as the CCC
 - Include cost estimates for console PCs, display hardware
 - Include estimates for software needed for both LHC and CMS
 - Include labor estimates for management and support personnel



Site Visits

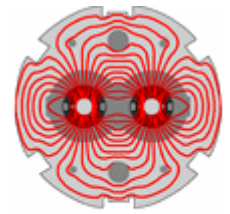


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- **Technology Research, Education, and Commercialization Center (TRECC) – West Chicago, Illinois** (Aug. 25, 2005)
- **Gemini Project remote control room – Hilo, Hawaii** (Sept. 20, 2005)
 - <http://docdb.fnal.gov/CMS-public/DocDB/ShowDocument?docid=425>
- **Jefferson Lab control room – Newport News, Virginia** (Sept. 27, 2005)
 - <http://docdb.fnal.gov/CMS-public/DocDB/ShowDocument?docid=505>
- **Hubble Space Telescope & STScI – Baltimore, Maryland** (Oct. 25, 2005)
- **National Ignition Facility – Livermore, California** (Oct. 27, 2005)
 - <http://docdb.fnal.gov/CMS-public/DocDB/ShowDocument?docid=532>
- **General Atomics – San Diego, California** (Oct. 28, 2005)
- **Spallation Neutron Source – Oak Ridge, Tennessee** (Nov. 15, 2005)
 - <http://docdb.fnal.gov/CMS-public/DocDB/ShowDocument?docid=570>
- **Advanced Photon Source – Argonne, Illinois** (Nov. 17, 2005)
- **European Space Operations Centre – Darmstadt, Germany** (Dec. 7, 2005)



Status & Summary



LARP

Status:

- We have started to work on the physical layout for LHC@FNAL, and are researching the tools needed for remote operations. This is needed for cost and schedule estimates.
- We are researching CERN computer and networking security issues.
- We have initiated a three-month trial of a commercial web collaboration tool (WebEx) that is being evaluated by several groups at Fermilab and may be used for the CMS Cosmic Challenge.
- In January of 2006 we will present our findings (requirements and resource loaded schedule) to the Fermilab Director.

Our primary focus is on defining how an operations centre can be used to help members of the LHC community (in North America) contribute their expertise to LHC activities at CERN.